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# PRELIMINARY OBSERVATIONS OF ACANTHOCINUS SPECTABILIS--LEC.

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## INTRODUCTION

The life history and habits of Acanthocinus spectabilis Lec. have been little studied. Craighead, F. C., (2) 1923, states, "This species occurs through the western United States and Canada, but is more abundant in the southwest. The adult flies from April to August."

Person, H. L., (7) 1928, summarizes an experiment to determine the effect of Acanthocinus spectabilis work upon the amount of emergence of Dendroctonus brevicomis from ponderosa pine. A quantity of infested bark was removed from a single tree and divided into two lots, one representing bark with much cerambycid work, the other with very little. The two lots were caged and the emergence recorded. The results showed that the bark with few Acanthocinus galleries yielded sixty pine beetles per square foot, while bark with much cerambycid work yielded only thirty-seven per square foot. This was considered significant because the bark was taken from one tree and the amount of cerambycid work was the only measurable factor of difference.

Keen, F. P., (5) 1929, states that A. spectabilis is a common secondary in ponderosa pine, closely following the attack of the western pine beetle. He notes the fact that this species causes some reduction of the pine beetle broods. The life cycle is considered to be one year.

Blackman, M. W., (1) 1931, states that A. spectabilis is the most important of the cerambycid robbers affecting Dendroctonus ponderosae on the Kaibab National Forest. This species reduces the brood of the Black Hills beetle both by robbing them of food and by eating immature stages of the beetle that happen to get in the way. The reduction was found in some cases to be over 50%. A. spectabilis development is closely synchronized with that of the Black Hills beetle. In rising infestations of the Black Hills beetle the cerambycids increase and during declining infestations they decrease since they are directly dependent upon the bark beetle to prepare suitable material for them. They are more abundant in the thick-barked trees which would otherwise be best for bark beetle development.

From these notes it can be seen that A. spectabilis is a factor in the natural control of Dendroctonus species in the pines in which it occurs. Being such a factor, it is desirable that we have information concerning the life history and habits of this insect. Most of the observations, from which the following comments were drawn, were made by Mr. Jack Bongberg who, in connection with a student problem, studied this insect in the spring of 1933 near Hackamore, California.

Additional information was obtained from the Bureau of Entomology note files at Berkeley.

## LIFE HISTORY NOTES

Hosts:

This species is a pine feeding form confined to the western states and Canada. It has been reared from Pinus ponderosa, Pinus ponderosa var. scopulorum, and Pinus lambertiana. Specimens have also been taken from the pupal cells in Pinus jeffreyi. In all probability this species occurs in other of the thicker barked pines in its range. It is doubtful whether it will be found to any great extent in Pinus contorta due to the very thin bark of that tree.

Characteristics of Attacked Trees:

On May 29th, 1933 a number of trees were examined which had been killed by D. brevicomis and later attacked by A. spectabilis. In every case the cerambycid larvae were found in trees that had been killed during the preceding year and especially in those trees which had been attacked and abandoned by D. brevicomis during the summer of 1932. Some larvae were found in trees containing overwintering pine beetle broods but this was the exception rather than the rule. The characteristics of the cerambycid infested trees may be summarized as: generally large, thick-barked, inner bark relatively moist, and foliage sorrel to fading.

Distribution on the stem:

The distribution of A. spectabilis on the bole of ponderosa pine has not yet been fully worked out. A. spectabilis and A. obliquus together infest approximately the same area that is attacked by the western pine beetle. A. spectabilis characteristically infests the lower bole where the bark is thick, while A. obliquus is commonly found in the upper portions of the stem where the bark is thin. Craighead's key (2) was used for all larval determinations.

It has been pointed out elsewhere, Furniss (4), that the low temperatures during the winter of 1932-33 reduced the broods of Acanthocinus spectabilis to about the same extent as broods of the western pine beetle. Living brood for the most part overwintered near the base of thick-barked trees. Probably broods of A. obliquus, being less protected, suffered to a greater extent from winter kill.

Development:

On May 29, 1933 when brood development had just begun, a number of infested trees were examined to determine the status of the brood. At

this time of year about one-fourth of the A. spectabilis larvae had made their pupal cells and were present in them as prepupal larvae. The remainder of the brood was in the large larval stage. In one instance eleven full-grown larvae and four prepupal larvae were found in and under one square foot of bark. The average per square foot although not determined would be considerably less than this. No attempt was made to determine the percent of bark surface mined by this insect. The sound which the larvae make as they bore through the bark occurs at irregular intervals and is plainly audible at a distance of several feet from an infested tree.

These observations indicate that most if not all of the larvae pass the winter in the last larval instar. Quite possibly further study will show that small larvae also overwinter. This is indicated by the fact that emergence of adults takes place over a period of several months in the summer.

June 6, 1933: On this date, a week after the initial examination, the same trees were visited which had been first observed. Ninety percent of the larvae had constructed pupal cells and had become prepupal larvae. Only a few larvae were encountered beneath the bark still in the process of active feeding.

June 7, 1933: On this day a most fortunate incident occurred. Mr. Bongberg describes the happening, " By mere chance I saw a prepupal larva transform into a pupa. When cutting into the pupal cell I saw that this particular individual looked as if it might shed its skin and as I was watching it that is exactly what it did. The skin started to split longitudinally down the head and the pupa began to emerge. The time required for the skin to be shed was exactly nineteen minutes. The body would be shaken violently for a short time then remain perfectly quiet for a time. Each time this was repeated the skin would be removed a little more."

The larvae spend their existence in the phloem region feeding upon the inner bark until just before pupation. When ready to pupate the large larvae bore diagonally upward into the outer bark where the pupal cells are hollowed out, a quarter inch to nearly an inch beneath the outer surface of the bark. The pupae lay in these cells with the ventral side out and the head up. By June 16, 1933 fully transformed adults were found in the pupal cells but no adults were observed in flight nor were any of the large conspicuous exit holes in evidence. An attempt to follow the development of individual larvae into the adult stage was unsuccessful due to an infestation of ants which destroyed all of the material under observation.

Emergence:

At Mackamore a green tree was caged at the base and an attack of D. brevicomis was forced upon it. The period of introduction of the pine beetles was from June 2nd to June 21st inclusive. Parent adults re-emerged from July 11th to August 3rd inclusive. Emergence of new adults took place between August 4th and October 13th for the most part, although a few stragglers continued to emerge during the late fall. On October 13th, 1933 one

Acanthocinus was taken from this cage. It was dead and at that time considerably eaten by ants although readily recognizable. It is most difficult to see how this specimen could possibly have gotten into the cage in any other way than to have developed there. In this case the developmental period would have been approximately four months. This point should be studied because such a rapid development shows a very close synchronization between the development of the pine beetle and the cerambycid.

During the course of the caging experiments at Hackamore four cages on overwintering D. brevicomis-killed trees exhibited emergence of A. spectabilis. Other cages might have shown emergence of this species had they been allowed to remain on the trees longer. Concerning the four cages in question, emergence of the pine beetle broods took place chiefly between June 4th and July 4th although one tree continued to show emergence until the middle of July. One cage yielded an Acanthocinus on July 14th and the others showed emergence between the 21st of July and the 2nd of August. Chart I shows the emergence of D. brevicomis and A. spectabilis from these four cages. No check was kept of the spring emergence of A. spectabilis from trees attacked and abandoned by the pine beetle during the preceding summer, although it was believed that most of the cerambycids overwintered in this type of tree.

Caging experiments similar to those at Hackamore were carried on at Bass Lake, California, on the Sierra National Forest by Mr. George Struble. Chart II shows the relationship between the emergence of the pine beetle and A. spectabilis in that region.

Importance:

The effectiveness of Acanthocinus as a control factor of the pine beetle is bound up directly with its ability or inability to follow Dendroctonus brevicomis into the trees almost at once and to develop rapidly. The fact that the pine beetle larvae mine into the outer bark almost immediately upon hatching makes the cerambycid work much less a natural reduction factor than when in association with a species such as the Black Hills beetle, the broods of which confine their activities to the phloem region almost entirely. Dendroctonus brevicomis on the whole is an insect which develops rapidly, especially during the summer. D. ponderosae undergoes a longer developmental period and hence is in association with the cerambycids for a longer time than is the western pine beetle. For these two reasons one would not expect A. spectabilis to reduce the broods of D. brevicomis to the same extent as broods of D. ponderosae.

As to the overwintering population of the western pine beetle there is an indication that the cerambycids may be of considerable importance in the reduction of this particular brood. The two species remain for a longer time in the same tree together and perhaps the late fall development of the cerambycids may account for the death of many pine beetles. In constructing their galleries the large cerambycid larvae excavate anywhere from one eighth

to a half inch of the outer bark. It would seem that in the thinner barked trees that this would account for more D. brevicomis mortality than in thicker barked trees. Whether this is the case or not remains to be investigated. It is evident from general field observations that the effect of A. spectabilis upon D. brevicomis is quite variable. Some trees containing much cerambycid work show very little emergence of the pine beetle, while other trees with just as much cerambycid work show no apparent reduction of pine beetle broods.

Parasites and Predators:

No specific work was done on this phase of the study. In 1930 in the Hackamore area several cases of Temnochila virescens larvae attacking large A. spectabilis larvae were noted when bark of infested trees was removed and the two species were allowed to come in contact with each other. The Temnochila larvae would sieze the large cerambycids in the mid section and bite until the body juices would ooze out. The final death struggles of the cerambycids were not noted. Since Temnochila feeds upon a great variety of insects including several other cerambycids it is probable that it is of considerable importance in the reduction of A. spectabilis. No parasites nor other predators were noted.

Asanthocinus obliquus:

This closely related species is of some interest. It has been stated that this species prefers the upper portions of the stem where the bark is relatively thin. It was observed to associate with Ips confusus in top killed ponderosa pines on the Sierra National Forest in 1932 and may be instrumental in the reduction of this Ips. Mr. D. DeLeon (3) outlines a brief life history of A. obliquus and states that it is relatively unimportant in controlling Dendroctonus monticolae in Pinus monticola. Mr. J. E. Patterson (6) in discussing A. pacificus ( A. obliquus ? ) in Pinus contorta considers this species to be of little importance in the control of the mountain pine beetle. Patterson gives a brief life history and several figures.

## SUMMARY

A review of the literature reveals the fact that little is known of the life history and habits of Acanthocinus spectabilis. It has been shown to be of some importance in the reduction of broods of Dendroctonus brevicomis and Dendroctonus ponderosae.

This species occurs throughout the western United States and Canada. It has been taken from Pinus ponderosae, Pinus ponderosae var. scopulorum, Pinus lambertiana and Pinus jeffreyi.

Large thick-barked ponderosa pines previously attacked by D. brevicomis are most attractive to A. spectabilis.

The preponderance of the brood passes the winter in the large larval stage. There is evidence to show that in Modoc county of California adults do develop and emerge in a single summer. Apparently most of the brood requires one year to complete the life cycle.

When the two species overwinter in the same tree together, emergence of A. spectabilis in ponderosa pine occurs from about the time that the pine beetle ceases to emerge until approximately two months later.

A. spectabilis seems to be of less importance in reducing broods of Dendroctonus brevicomis than broods of Dendroctonus ponderosae.

Temnochila virescens is a possible predator of A. spectabilis. No parasites nor other predators were noted.

Acanthocinus obliquus is found in association with Ips confusus in top killed ponderosa pine. It is considered to be of little importance in the reduction of the mountain pine beetle either in white pine or lodgepole pine.

## REFERENCES

(1) Blackman, M. W., 1931, "The Black Hills Beetle."

(2) Craighead, F. C., 1923, "North American Cerambycid Larvae."

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(4) Furniss, R. L., 1934, "Additional Observations of the 1932-33 Mortality of Forest Insects Due to Freezing - - Northern California."

(5) Keen, F. P., 1929, "Insect Enemies of California Pines and Their Control."

(6) Patterson, J. E., 1928, "Studies of the Mountain Pine Beetle in Lodgepole Pine and Other Studies Conducted in Southern Oregon in 1927."

(7) Person, H. L., 1928, "A Study of the Clerid, Thanasimus nigriventris Lec., with Note on Other Insect Enemies of the Western Pine Bark Beetle."

CHART I
HACKAMORE

| Tree # | Species | May 27 | 31 | JUNE 2 | 4 | 6 | 8 | 10 | 12 | 13 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | JULY 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 21 | AUG. 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D.b. | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 28 | 62 | 230 | 136 | 164 | 154 | 102 | 103 | 25 | 12 | 13 | 11 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 2 | D.b. | 0 | 0 | 0 | 1 | 8 | 13 | 28 | 231 | 103 | 43 | 11 | 11 | 4 | 9 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 3 | D.b. | 0 | 0 | 0 | 0 | 1 | 2 | 9 | 116 | 97 | 56 | 27 | 34 | 54 | 22 | 12 | 4 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 4 |
| 4 | D.b. | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 20 | 59 | 136 | 203 | 198 | 325 | 91 | 77 | 148 | 78 | 24 | 11 | 6 | 4 | 0 | 2 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |

D.b. = Dendroctonus brevicomis
A.s. = Acanthocinus spectabilis

CHART II
HASS LAKE

| Tree # | Species | MAY 21 | 25 | 29 | JUNE 1 | 5 | 9 | 16 | 24 | JULY 1 | 8 | 15 | 22 | 29 | AUG. 5 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | D.b. | 8 | 64 | 279 | 7 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | 1 | | | 5 | | 4 | 1 | | 1 | | | 2 |
| 2 | D.b. | 0 | 0 | 5 | 11 | 20 | 97 | 226 | 96 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | | 1 | |
| 3 | D.b. | 1 | 1 | 111 | 148 | 49 | 505 | 201 | 12 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | 1 | | 2 | 4 |
| 4 | D.b. | 7 | 116 | 412 | 103 | 15 | 82 | 3 | 32 | 6 | 2 | 0 | 0 | 0 | 0 | 0 |
| | A.s. | | | | | | | | | | | | | 1 | | 1 |

D.b. = Dendroctonus brevicomis
A.s. = Acanthocinus spectabilis